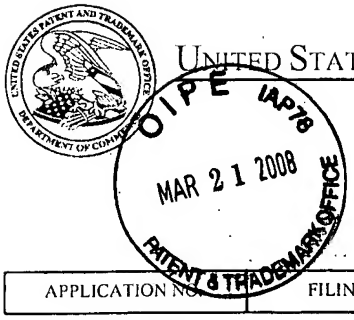

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,884	10/12/2004	YONGMIN WANG		5883

46519 7590 01/29/2008

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UNITED KINGDOM

EXAMINER	
ABEBE, DANIEL DEMELASH	
ART UNIT	**PAPER NUMBER**
2626	

MAIL DATE	DELIVERY MODE
01/29/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/711,884	WANG ET AL.	
	Examiner	Art Unit	
	Daniel D. Abebe	2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

The invention

The subject matter of the claimed invention is related to improving the user interface of digital devices having Chinese character keys for input. More particularly, the invention is related to a method for numerically encoding the Chinese characters by decomposing them into six unique code elements where the six code elements are mapped onto six numeric keys.

DETAILED ACTION

Priority

Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, or 365(c) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 119(e) as follows:

Acknowledgment is made of applicant's claim for foreign priority based on an application filed in China, Singapore and UK on 2/16/04, 8/18/04 and 9/3/04 respectively. It is noted, however, that applicant has not filed a certified copy of the claimed foreign applications as required by 35 U.S.C. 119(b).

Oath/Declaration

The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:

The specification to which the oath or declaration is directed has not been adequately identified. See MPEP § 602.

It does not identify the foreign application for patent or inventor's certificate on which priority is claimed pursuant to 37 CFR 1.55, and any foreign application having a filing date before that of the application on which priority is claimed, by specifying the application number, country, day, month and year of its filing.

Claim Rejections - 35 USC § 112

Claims 2, 5, 8 and 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 2, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Regarding claims 5, 8 and 10, the phrase "for example" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claims 1-11 are rejected as failing to define the invention in the manner required by 35 U.S.C. 112, second paragraph.

The claim(s) are narrative in form and replete with indefinite and functional or operational language. The structure which goes to make up the device must be clearly and positively specified. **The structure must be organized and correlated in such a**

manner as to present a complete operative device. The claim(s) must be in one sentence form only. Note the format of the claims in the patent(s) cited.

Claim Objections

Claims 2- 11 are objected to because of the following informalities:

Claims 2-11 are objected for lack of antecedent basis of method in claim 1.

Specifically claim 1 claims the system but it is referred as a method claim in the corresponding dependent claims.

Also in claim 1, it appears that the phrase "less **then**" on line 8 was meant to be "less than". Appropriate correction is required.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel D. Abebe whose telephone number is 571-272-7615. The examiner can normally be reached on monday-friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Hudspeth can be reached on 571-272-7843. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Daniel Abebe Primary Examiner A.U. 2626

December 31, 2007

Notice of References Cited	Application/Control No. 10/711,884	Applicant(s)/Patent Under Reexamination WANG ET AL.	
	Examiner Daniel D. Abebe	Art Unit 2626	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,119,296	06-1992	Zheng et al.	715/535
*	B	US-6,922,811	07-2005	Leung et al.	715/535
*	C	US-5,307,269	04-1994	Kohno, Hiromi	701/68
*	D	US-6,393,445	05-2002	Chien, Ha Chun	715/536
*	E	US-6,094,666	07-2000	Li, Peng T.	715/535
*	F	US-5,790,055	08-1998	Yu, Cho Jen	341/28
*	G	US-5,586,198	12-1996	Lakritz, David	382/185
*	H	US-4,173,753	11-1979	Chou, Hsu Ching	382/185
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Jinan Qiao et al. "Six-Digit Coding Method" □□ACM pp 491-494
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Edgar H. Sibley
Panel Editor

The Six-Digit Coding Method (SDCM) is a new coding method for Chinese characters. It is based on the structural analysis of Chinese characters. We recently developed this method and have successfully used it to code 11,100 characters, including the simplified, traditional, and variant forms found in Xin Hua Dictionary *[7]. This article illustrates the basic principles, features, and some viewpoints concerning the method.*

Six-Digit Coding Method

Jinan Qiao, Yizheng Qiao, and Sanzheng Qiao

In Chinese, there are approximately 2,000–4,000 commonly used characters plus a few thousand more technical characters. It is impossible to have one key for each character. Thus, a coding system for Chinese characters is not only the basis for Chinese information interchange, but also an important tool in communication, text processing, and many other fields. A good coding method can benefit the modernization of China directly, since it is essential for a computer input system. More than one hundred Chinese character coding systems have been proposed, and some of them have been adopted as tools for communication and text processing [2, 3, 8]. They have various shortcomings however, and researchers are still looking for better coding methods. As computers begin to gain widespread use in China, there is an urgent need for a good coding system; yet there is no standard Chinese coding system at the present time.

Chinese characters incorporate shape, sound, and complex hieroglyphic meanings into an ideographic language, which is different from alphabetic languages used in most countries around the world. Consequently, there are several major difficulties in developing a good coding system. We think a good method should meet the following four requirements.

First, versatility is important. There are many forms of Chinese characters because of all the changes and complications in the long history of the Chinese language. For example, there are the traditional, variant, and simplified forms, which are unavoidable in studying ancient Chinese history. A coding system tailored to represent only the simplified form is obviously not good enough. How to code all forms of characters is not only a major challenge, but also required by the computerized study of the rich history of China.

Second, a standard style is essential for a standard coding method. There are many different shapes and complicated structures, since Chinese characters are evolved from ideographs. Common printing fonts include the Old Song, Fang Tou, Zheng Kai, Fang Song, and Li Shu; handwriting styles include Li, Zhuan, Cao, Hang, Kai, and Mei Shu. Different styles may lead to different codes. Therefore, it is necessary to choose a widely used style as the standard.

Third, the One Code, One Character (OCOC) doctrine, i.e., every code should have only one corresponding character and vice versa, is obviously desirable. At present, most coding systems cannot satisfy this. For example, the methods based on Pinyin are One Code, Multiple Characters (OCMC); i.e., one code has many corresponding characters sharing a common pronunciation. The Pinyin System consists of 403 different sounds [7] that are pronunciations of Chinese characters. Each sound can be read in four different tones that may not be used as input into a computer system. On the average, every sound corresponds to 17 characters with totally different meanings. For example, in the *Xin Hua Dictionary*, the Pinyin *shi* represents 78 characters that include: city, scholar, food, to lose, matter, wet, poem, lion, world, dead body, ten, stone, time, real, to be, to drive, to try. The Pinyin *fu* has 98 different characters, *ji* 119, and *yi* 131. The context provides the only means of distinguishing between them in spoken Chinese. On a computer, even if the users are familiar with Pinyin, they must look for the desired character among all the different characters. Furthermore, China has eight major dialects with totally different pronunciations [4]. A coding system based on pronunciation can raise severe problems in inputting Chinese into a computer system. Clearly, OCOC is a requisite in good Chinese character coding systems. A major disadvantage of current OCOC systems, such as the Standard Code of Chinese Characters [6], is that the operator has to find the code in a chart that contains thousands of characters each time a character is entered.

Finally, a good coding system should be simple enough so that users can quickly figure out the code when they see a character. This is termed "See Character, Know Code" (SCKC). In this way, the method can be grasped easily without vast knowledge of the Chinese language.

Six-Digit Coding Method (SDCM) is designed to meet

all of the above requirements. It is the first coding method which is based on the shape of characters. This article is organized as follows. We first illustrate the principles of this method. The coding rules are briefly explained next, and the advantages of this method are summarized. Finally, we discuss various viewpoints.

THE PRINCIPLES

In SDCM, a Chinese character is divided into six sections. Each section is represented by a decimal digit. All six digits then make up a code that denotes the character. The standard form of characters for this method is in accordance with a standard, the *Font Table of Commonly Used Characters in Printing*, jointly published by the Ministry of Culture and the Language Reform Committee of the People's Republic of China, in Beijing, 1964. For convenience, we have adopted the most widely used Old Song style. A Chinese character can consist of single, double, and triple structures or combinations of these. For example, the character 小 is considered to have a single structure, the character 妈 a double structure, and 断 a triple structure. On this basis, we classify each character into one of the following four types of structures:

1. Single and Double Structures

A character of this type is divided into six sections as shown in Figure 1.

Section 1 is the upper left corner;
Section 2 is the lower left corner;
Section 3 is the upper right corner;
Section 4 is the lower right corner;
Section 5 is the combination of Section 1 and Section 3;
Section 6 is the combination of Section 2 and Section 4.

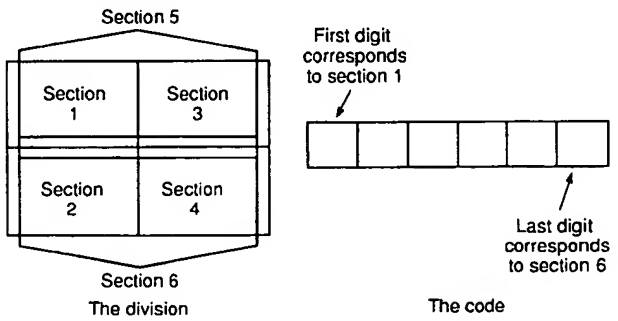


Figure 1. The Division of a Chinese Character and Its Code

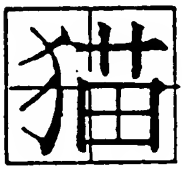
We have categorized about 100 commonly used strokes into nine comprehensive groups, and assigned digits 1–9 to these groups. The coding table of strokes is not included here.

Each section is coded by a decimal digit that corresponds to the stroke of the character that occupies the section and belongs to the group to which the digit is assigned. Unoccupied sections or sections with ungrouped strokes are represented by the digit 0. Section 1 corresponds to the left-most digit; section 2 corresponds to the second left-most digit; and so on.

Example 1 (single structure). The stroke ㇒, assigned to group 2, sticks out to the left in section 2, so the second digit of the code is 2. Likewise, the fourth and fifth digits are 7 and 3 respectively. We usually do not code a stroke twice, so the code for this character is 020730 as shown below. The next section gives more details of the coding rules.

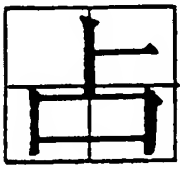
section 1 - 0
section 2 - ㇒ 2
section 3 - 0
section 4 - 丶 7
section 5 - 亅 3
section 6 - 0

Example 2 (left-right double structures). Similar to Example 1, each of the sections 1 to 4 is coded by a digit that corresponds to the stroke occupying this section.



section 1 - 𠂉 4
section 2 - 丿 2
section 3 - 艹 6
section 4 - 田 5
section 5 - 0
section 6 - 0

Example 3 (upper-lower double structure). Here, section 1 is unoccupied. Section 2 has a stroke that belongs to group 9. Similarly, sections 3 and 5 are coded by 1 and 3 respectively.



section 1 - 0
section 2 - 曰 9
section 3 - 一 1
section 4 - 0
section 5 - 丨 3
section 6 - 0

2. Triple Structure

In this type, a character is divided into six sections as shown in Figure 2. Notice that sections 5 and 6 are at the upper half and lower half of the middle structure respectively.

Section 1	Section 5	Section 3
Section 2	Section 6	Section 4

Figure 2. The Division Pattern of Type 2

Example 4 (triple structure). The coding is shown as follows. Although two of the strokes are not coded, the OCOC requirement can still be satisfied.

section 1 - 9
section 2 - 0
section 3 - 2
section 4 - 3
section 5 - 3
section 6 - 1

3. Double Structured Upper Half Plus Triple Structured Lower Half

In this type, a character is divided into six sections as shown in Figure 3.

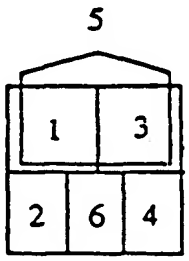


Figure 3. The Division Pattern of Type 3

Example 5. This example shows a character with type 3 structure. Again, some strokes are not coded, but six digits are sufficient to identify this character.

section 1 - 5
section 2 - 1
section 3 - 4
section 4 - 7
section 5 - 0
section 6 - 7

4. Triple Structured Upper Half Plus Single or Double Structured Lower Half

The division pattern is shown in Figure 4.

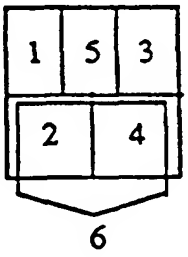


Figure 4. The Division Pattern of Type 4

Example 6. Here we give an example of type 4 structure.

section 1 - 7
section 2 - 1
section 3 - 2
section 4 - 1
section 5 - 4
section 6 - 2

THE CODING RULES OF SDCM

All basic building blocks of Chinese characters and their corresponding codes are listed in the coding table of strokes. A character is first classified into one of the four types; then it is coded digit by digit from section 1 to section 6. If the start or the end of a stroke sticks out in a section, then this stroke is chosen to code the section. A stroke cannot be coded more than once, unless it crosses other strokes. If it crosses another stroke once, it may be coded twice; and if it crosses twice, it may be coded three times. In writing Chinese, characters are generally written from top to bottom, left to right. The start of a stroke is where you begin the stroke, and the end of a stroke is where you finish the stroke.

SDCM utilizes this feature in its coding. For example, in the character 妈, there are two strokes starting in section 1, namely 𠂉 and 丿. The former is selected to code this section because it is higher than the latter. In section 2, 丿 is chosen because its end is more exposed at the lower left corner than 𠂉 is. Similarly, 𠂇 is picked for section 3, and 𠃌 is selected for section 4. In section 5, 𠂉 is selected again because it is the most exposed and it crosses 丿. For section 6, 一 is coded. Thus, according to the coding table, the code for 妈 is 377831. Another example for the crossing rule is the character 更, whose code is 111242.

THE ADVANTAGES OF SDCM

First, SDCM adopts the Old Song style which is unified, widely established, and used in printing. To avoid errors in coding, we have standardized SDCM by revising a few of the irregularly formed characters that resulted from printing errors.

Second, 11,100 characters have been coded with

SDCM, and no two characters share the same code. This fulfills the OCOC requirement.

Third, SDCM is the first method of coding based on the shape of characters. It is efficient and convenient. To code a character, a stroke is selected for each section and then its shape is compared with the strokes in the coding table to determine the digit for this section. In other words, the code only depends on the positions and shapes of the strokes in the characters. It is independent of the order of the strokes in the character. Consequently it makes SCKC possible and requires little knowledge of the Chinese language. Furthermore, on the basis of psychological analysis done in China, people recognize a character by first looking at the exposed parts of the sections of the characters at the sides and corners. If they still cannot tell what the character is, they then proceed to look at the subtle differences in the middle [5, 9]. Therefore, the four corners of the character sections, as well as the top and the bottom can be effectively used to differentiate between various characters. After coding thousands of characters, we have found that six sections suffice to identify a character even when some strokes are not coded, as shown in Examples 4, 5, and 6 in the previous section.

Fourth, by using six decimal digits to code Chinese characters, we can potentially code one million characters and still achieve the OCOC requirement. It is estimated that there are 50,000–60,000 characters in total.

Finally, with SDCM, one can code characters quickly. We expect that anyone with limited knowledge of Chinese would be able to master all the coding rules and code characters, without checking the coding table, after only two or three days of training. The code can then be quickly entered on a numerical keyboard.

SOME VIEWPOINTS

Some critics say that a six-digit number is too long for one character and that it would slow down the input speed. For instance, they argue that the Pinyin System requires an average of three keystrokes to input the Pinyin of a character, but SDCM always needs six keystrokes per character, thus the input speed for Pinyin to SDCM is 1:2. The difference here is that the six keystrokes in SDCM call up the exact desired character because SDCM satisfies the OCOC requirement. In contrast, after the three keystrokes in Pinyin, you have identified only the pronunciation of the character, and you still have to choose the exact character of interest among all the characters that share the same pronunciation. The actual number of characters to choose from can range from three or four to over one hundred, depending on the specific pronunciation. The average, as we noted in the introduction, is seventeen. Since we plan to code 50,000 to 60,000 characters with the SDCM, six decimal digits are necessary. Moreover, SDCM is designed to reduce the amount of memorization. The additional typing can be compensated by the efficiency and the convenience of coding with the method.

The SDCM provides a useful tool for Chinese character processing on computers. We believe that the SDCM has a great impact on Chinese information processing because it adopts the standard style, achieves One Code, One Character, and can be used to code all forms of characters efficiently. We have already coded over eleven thousand characters, and we plan to develop an SDCM software and use neural networks to code characters.

REFERENCES

1. Archer, N.P., et al. A Chinese-English microcomputer system. *Commun. ACM* 31, 8 (Aug. 1988), 977–982.
2. Chen, C.K., and Gong, R.W. Evaluation of Chinese input methods. *Comput. Process. Chinese & Oriental Lang.* 1 (Nov. 1984), 236–247.
3. Chiu, A., and Wong, F. An intelligent, knowledge-based Chinese input system. *Comput. Process. Chinese & Oriental Lang.* 3 (May 1987), 25–32.
4. DeFrancis, J. *The Chinese Language: Fact and Fantasy.* Univ. of Hawaii Press, Honolulu, Hawaii, 1984.
5. Li, J.L. Ji Zhong Shi Zi Xin Li Chu Tan (A primary research on [the] psychology of character recognition). In *Ji Zhong Shi Zi Jiao Xue Xuan (Selected Articles on the Education of Character Recognition)*, Edited by the Central Research Institute of Science of Education. Science of Education Publishing Co., Beijing, 1980, 195–215. (In Chinese)
6. *The People's Republic of China National Standard Code of Chinese Graphic Characters Set for Information Interchange Primary Set.* Technical Standards Press, Beijing, 1981. (In Chinese)
7. *Xin Hua Dictionary*, 6th ed. Shang Wu Press, Beijing, 1987. (In Chinese)
8. Yu, W.C.P., and Chen, T.C. Two-level encoding for Chinese input systems. *Comput. Process. Chinese & Oriental Lang.* 1 (1984), 225–235.
9. Zhou, Y.G. *Zhong Guo Yu Wen de Xian Dia Hua (The Modernization of Chinese Language).* Shanghai Education Publishing Company, Shanghai, 1986. (In Chinese)

CR Categories and Subject Descriptors: H.4.1 [**Information Systems Applications**]: Office Automation; I.7.1 [**Text Processing**]: Text Editing
General Terms: Languages
Additional Key Words and Phrases: Chinese coding method, Chinese input system, Chinese text processing

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* Please direct all correspondence to the third author: Sanzheng Qiao, Dept. of Computer Science and Systems, McMaster University, Hamilton, Ontario, Canada, L8S 4K1.

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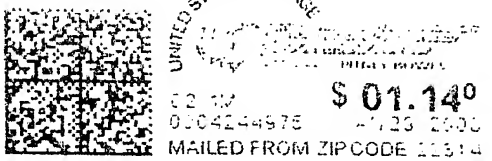

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